Chapter 14: Water Quality

14.1 Introduction

This chapter describes the existing conditions of surface water and groundwater and the expected impacts from the Mountain View Corridor (MVC) alternatives in the water quality impact analysis area.

Water Quality Impact Analysis Area. The water quality impact analysis area for water resources includes the MVC study area, adjacent water bodies such as the Great Salt Lake, and associated watersheds. The main water bodies of importance are Utah Lake and the Jordan River. See Figure 14-1, Watersheds and Water Bodies, for the water quality impact analysis area.

14.2 Regulatory Overview

Water quality in Utah is regulated by the U.S. Environmental Protection Agency (EPA) through the federal Clean Water Act and by the regulations of the Utah Department of Environmental Quality (UDEQ) Division of Water Quality and Division of Drinking Water as outlined in the Utah Administrative Code, Rules 317 and 309 (UAC R317 and R309). These regulations are summarized below.

14.2.1 Water Quality Standards

Under the Clean Water Act, every state must establish and maintain water quality standards designed to protect, restore, and preserve the quality of waters in the state. These standards consist of narrative standards for all waters, specific numeric chemical and biological criteria necessary for protection of the designated uses, and antidegradation provisions.

Water bodies are considered to have various beneficial uses such as providing drinking water, supporting wildlife, and supporting recreation. Numeric standards for water quality are intended to protect the beneficial uses of the water, such as drinking water, supporting game fish, or swimming. Narrative standards are more general statements that prohibit unacceptable water quality conditions such as visible pollution. Antidegradation provisions are intended to maintain high-quality waters at levels above the applicable water quality standards.

UDEQ classifies surface water bodies in the state according to how the water is used, and each classification has associated numeric standards. The classes of water bodies and their beneficial uses are described in Table 14.2-1.

Table 14.2-1. Designated Beneficial Uses for River Streams, Lakes, and Reservoirs in Utah

Class	Description
1	Protected for use as a raw water source for domestic water systems.
1C	Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water.
2	Protected for recreational use and aesthetics.
2A	Protected for primary contact recreation such as swimming.
2B	Protected for secondary contact recreation such as boating, wading, or similar uses.
3	Protected for use by aquatic wildlife.
3A	Protected for cold-water species of game fish and other cold-water aquatic life, including the necessary aquatic organisms in their food chain.
3B	Protected for warm-water species of game fish and other warm-water aquatic life, including the necessary aquatic organisms in their food chain.
3C	Protected for nongame fish and other aquatic life, including the necessary aquatic organisms in their food chain.
3D	Protected for waterfowl, shore birds, and other water-oriented wildlife not included in classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain.
3E	Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife.
4	Protected for agricultural uses including irrigation crops and stock watering.
5	The Great Salt Lake. Protected for primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including the necessary aquatic organisms in their food chain, and mineral extraction.

Source: Utah Division of Water Quality 2006

14.2.2 Impaired Waters and Total Maximum Daily Loads

When a lake, river, or stream fails to meet water quality standards for its designated use, Section 303(d) of the Clean Water Act requires that the state place the water body on a list of "impaired" waters (also known as a Section 303(d) list) and prepare an analysis called a Total Maximum Daily Load.

To comply with the Clean Water Act, the Utah Division of Water Quality identifies water bodies that do not meet state water quality standards and submits a Section 303(d) list of these impaired waters to EPA biannually. The Division conducts a Total Maximum Daily Load analysis on the impaired waters to determine the maximum contaminant load that the water body can accept and still meet the standards. The Division then assigns point-source dischargers (that is, holders of Utah Pollutant Discharge Elimination System permits) a numeric limit for the maximum amount of particular pollutants they can discharge based on the Total Maximum Daily Load analysis.

14.2.3 Surface Water Discharges

EPA has delegated authority for the National Pollutant Discharge Elimination System (NPDES) program in Utah to UDEQ. Under this program, industries and companies that could discharge wastewater, stormwater, or other pollutants into water bodies must obtain a Utah Pollutant Discharge Elimination System (UPDES) permit to minimize impacts to water quality.

14.2.4 Groundwater Discharges

The Utah Water Quality Board classifies aquifers according to their quality and use (such as ecologically important, irreplaceable, drinking water quality, and saline). The Utah Division of Water Quality publishes numeric standards for each class of aquifer. Any person can petition the Board to classify an aquifer. In addition, the Division requires groundwater permits for activities that discharge pollutants into groundwater.

14.2.5 Drinking Water Source Protection Plans and Zones

Owners of water systems are responsible for protecting sources of drinking water and for submitting a Drinking Water Source Protection Plan to the Utah Division of Drinking Water. Drinking Water Source Protection Plans must identify drinking water source protection zones around each drinking water source (such as a lake, river, spring, or groundwater well), existing sources of contamination, and the types of new construction projects that are restricted within each zone.

The Utah Division of Drinking Water requires the Drinking Water Source Protection Plan to identify four distinct drinking water source protection zones for each well:

- Zone 1 is the area within a 100-foot radius of the wellhead.
- Zone 2 is the area within a 250-day groundwater time of travel to the wellhead.
- Zone 3 is the area within a 3-year groundwater time of travel to the wellhead.
- Zone 4 is the area within a 15-year groundwater time of travel to the wellhead.

Owners of public water systems are responsible for protecting drinking water sources from contamination. Methods of ensuring that water quality is protected are zoning ordinances and land-use restrictions within each source protection zone. Owners of drinking water systems decide if roads are an allowable form of development within each of the various drinking water protection zones. In general, well owners would consider transportation development within source protection Zone 1 to be a negative impact to the well and would not allow development within that zone. Well owners would determine whether development in the other source protection zones is allowed based on the subsurface conditions around each well.

14.2.6 High-Quality Waters

UDEQ regulations state that surface waters whose existing quality is better than the established standards for the designated uses should be maintained at high quality (that is, a project cannot cause the existing water quality to be degraded).

Table 14.2-2 below shows the water quality regulations that apply to the MVC project.

Table 14.2-2. Water Quality Regulations

Regulation	Regulatory Agency and Requirement	Applicability
Clean Water Act Section 401 State Water Quality Certification	EPA requires UDEQ to certify that the project would not cause Utah water quality standards to be exceeded.	**Water Quality Certification** UDEQ provides this certification to the U.S. Army Corps of Engineers.
Clean Water Act Section 402 (UAC R317-8) NPDES Permit (UPDES in Utah) (Limits discharges)	EPA has delegated authority for the National Pollutant Discharge Elimination System (NPDES) program in Utah to UDEQ. Industrial projects that discharge stormwater to surface water and construction projects that disturb more than 1 acre of land must obtain a Utah Pollutant Discharge Elimination System (UPDES) permit to minimize impacts to water quality.	**UPDES Permits** Required for roadway construction such as the Mountain View Corridor.
Clean Water Act Section 303(d) Total Maximum Daily Load for Impaired Waters (Limits discharges)	EPA requires the Utah Division of Water Quality to identify water bodies that do not meet state water quality standards and therefore do not support their designated beneficial use. The Division submits a 303(d) list of these impaired waters to EPA biannually. The Division conducts a Total Maximum Daily Load analysis on the impaired waters to determine the maximum contaminant load that the water body can accept and still meet the standards. The Division then assigns point-source dischargers (UPDES permit holders) a numeric limit for the maximum amount of particular pollutants they can discharge based on the Total Maximum Daily Load analysis.	**Impaired Waters** A Total Maximum Daily Load analysis is currently in progress but is not available for the Jordan River/Utah Lake watershed area (Utah Division of Water Quality 2007).
UAC R317-2-7.2 Narrative Water Quality Standards (Limits discharges)	This regulation states that it is unlawful to discharge substances that could cause undesirable effects on human health or aquatic life into surface waters.	**Narrative Standards** All surface waters near the water quality impact analysis area.
UAC R317-2-14 Numeric Criteria (In-stream standard)	Numeric standards for water quality are based on the beneficial use, such as providing drinking water, supporting game fish, or swimming. Projects cannot cause water quality standards to be exceeded. If a standard is already being exceeded, a Total Maximum Daily Load limit could be applied to the project.	**Numeric Standards** Discharges cannot exceed the current numeric standard.
UAC R317-2-3 Anti-degradation Policy of High-Quality Waters (In-stream standard)	UDEQ regulations state that waters whose existing quality is better than the established standards for the designated uses would be maintained at high quality (that is, the project cannot cause the existing water quality to be degraded).	**High-Quality Waters** None.
UAC R309-605 Drinking Water Source Protection for Surface Waters (Regulates activities near drinking water sources)	Owners of public water systems are responsible for protecting sources of drinking water and for submitting a Drinking Water Source Protection Plan to the Utah Division of Drinking Water. Drinking Water Source Protection Plans must identify drinking water source protection zones around each drinking water source (such as a lake or river), existing sources of contamination, and the types of new construction projects that are restricted within each zone.	**Source Protection** The Jordan River in Utah County is a Drinking Water Source Protection.

14.3 Affected Environment

14.3.1 Resource Identification Methods

Information from Utah state water plans, the Clean Water Act 303(d) listing, and other data collected from UDEQ, the Division or Drinking Water, the Division of Water Rights, and the Division of Water Quality were used to describe the affected environment.

The water quality impact analysis area lies within two watersheds (also known as drainage basins), the Jordan River Watershed and the Utah Lake Watershed, as shown in Figure 14-1, Watersheds and Water Bodies. The dividing line between the Utah Lake and the Jordan River watersheds is the Utah County–Salt Lake County line near the Jordan Narrows (Utah Division of Water Quality, no date).

14.3.2 Resources in Salt Lake County

14.3.2.1 Surface Waters and Beneficial-Use Classifications in the Jordan River Watershed

The Jordan River flows northward out of Utah Lake for about 44 river miles to the location where it empties into the Great Salt Lake (Utah Division of Water Resources 1997a). The Jordan River watershed includes all land that drains into the Jordan River from the Jordan Narrows northward to the location where the river empties into the Great Salt Lake (this inlet is outside the water quality impact analysis area). The Jordan River watershed is unique in that it is a closed basin formed by three mountain ranges (the Wasatch on the east, the Oquirrh on the west, and the Traverse Range on the south) and the Great Salt Lake.

Elevations in the Jordan River watershed range from about 4,200 feet at the Great Salt Lake to over 11,000 feet in the mountains. As a result of the large differences in elevation, average annual precipitation also varies greatly, ranging from 12 inches in the lower valley to over 50 inches in the highest mountain areas (Utah Division of Water Quality, no date).

The Jordan River is fed by a number of tributary streams. The largest of these tributary streams originate in the Wasatch Mountains east of the river. There are no major streams that originate west of the Jordan River.

Surface water provides about 74% of the developed water supply in the Jordan River watershed. The largest use of the developed water supply is public drinking water systems. Most of the surface water used for agriculture in the watershed comes from the Jordan River (Utah Division of Water Resources 1997a), and most public drinking water comes from surface water outside the water quality impact analysis area. Because agricultural land is being converted to residential uses, the demand for public (culinary) water is increasing. Table 14.3-1 provides a summary of surface waters in the Jordan River watershed within the water quality impact analysis area and their beneficial-use classifications.

Table 14.3-1. Surface Waters and Beneficial Uses in the Salt Lake County Portion of the Water Quality Impact Analysis Area

County/ Watershed	Water Body[a]	Beneficial Uses
Salt Lake County/ Jordan River Watershed	Surplus Canal	2B (secondary contact), 3B (warm-water fish species), 3D (waterfowl), 4 (agriculture)
	Kersey/Lee Creek	2B (secondary contact), 3D (waterfowl) from confluence of C-7 ditch to headwaters
	Coon and Harker's Canyon Creeks	2B (secondary contact), 3D (waterfowl), 4 (agriculture)
	Barney's Canyon Creek	2B (secondary contact), 3D (waterfowl), 4 (agriculture)
	Bingham Creek	2B (secondary contact), 3D (waterfowl), 4 (agriculture)
	Butterfield Creek	2B (secondary contact), 3D (waterfowl), 4 (agriculture)
	Rose Creek	2B (secondary contact), 3D (waterfowl), 4 (agriculture)
	Jordan River	2B (secondary contact), 3A (cold-water fish species), 4 (agriculture)

[a] For the Salt Lake County surface waters listed, the beneficial use includes the entire water body reach.

Source: UAC R317-2-13, Classification of Waters of the State, as in effect February 17, 2006

There are other creeks and canals in the Salt Lake County portion of the water quality impact analysis area in addition to those shown above in Table 14.3-1. These creeks and canals, and any others that are not specifically designated in UAC R317-2-13, use the default beneficial-use classifications of 2B (secondary contact) and 3D (waterfowl) (UAC R317-2-13.14). The narrative standard also applies to these waters.

14.3.2.2 High-Quality Waters

There are no high-quality waters in the Salt Lake County portion of the water quality impact analysis area (UAC R317-2-12, High-Quality Waters, as in effect May 10, 2007).

14.3.2.3 Impaired Waters

The major activities that cause water quality impacts in the Jordan River watershed are resource extraction, habitat modification, stream modification, agricultural activities, and urban stormwater runoff (Utah Division of Water Quality 2002, iv).

The Jordan River from the Jordan Narrows (at the Salt Lake County–Utah County line) north to Bluffdale does not meet the numeric standards for beneficial-use classification 3A (cold-water species of game fish) due to high temperatures (see Table 14.3-2). The specific cause of the high temperatures in this segment of the Jordan River is unknown (Utah Division of Water Quality 2002, 19). High nutrient loads of elements such as nitrogen and phosphorus and low flows can contribute to high temperatures. As noted above in Table 14.2-2, Water Quality Regulations, a Total Maximum Daily Load analysis is being prepared for the Jordan River but has not yet been published (Utah Division of Water Quality 2007). No other waters in the Salt Lake County portion of the water quality impact analysis area are listed as impaired waters.

Table 14.3-2. Impaired Waters in the Salt Lake County Portion of the Water Quality Impact Analysis Area

Watershed	Water Body	Impaired Beneficial Use	Standards Not Met
Jordan River watershed	Jordan River (from Jordan Narrows to Bluffdale)	3A (cold-water fish)	Temperature

Source: Utah Division of Water Quality 2004, 29, 51

14.3.2.4 Groundwater Quality

Groundwater provides about 26% of the presently developed water supply in the Jordan River watershed (Utah Division of Water Resources 1997a, 2-9). Groundwater occurs in unconsolidated deposits in a deeper principal aquifer that is confined, or under pressure, and in a shallower aquifer that is not confined. Recharge occurs from the mountains on the east and west sides of the valley. Groundwater moves from the base of the Oquirrh Mountains eastward toward the Jordan River. The Jordan River drains both surface water and groundwater from the valley (Haraden 2002, 24).

Groundwater in the Salt Lake Valley’s principal aquifer is generally of good quality on the east side of the Jordan River, with the quality becoming poorer on the west side of the river (Utah Division of Water Resources 1997a, 2-9). This poorer water quality on the west side of the valley is due in part to past mining activities that contaminated the aquifer and due to geological conditions in the area. Compared to the southeast side of the valley, the rate of groundwater recharge is slower on the west side, which means longer contact times to dissolve subsurface minerals (USGS 2001, 18). The water quality of the shallow unconfined aquifer is generally poor and occurs at varying depths from 14 feet near Interstate 80 (I-80) to 170 feet where the MVC alternatives are near the Oquirrh Mountains. North of 3500 South, the groundwater flow is north toward the Great Salt Lake, and south of 3500 South, the flow is to the east. There is an upward gradient from the principal aquifer to the shallow aquifer over a large percentage of the valley.

Groundwater wells are constructed with low-permeability plugs such as bentonite clay to prevent surface water or poor-quality shallow groundwater from leaking into the higher-quality deeper principal aquifer. Overpumping of the principal aquifer is a major concern because it could cause a reversal of the upward gradient. One of the Jordan River basin's main water resource challenges is reducing groundwater contamination (Utah Division of Water Resources 1997a, 2-3).

According to the Utah Division of Drinking Water, there are no aquifers classified as protected in the Salt Lake County portion of the water quality impact analysis area (Herbert 2004).

14.3.2.5 Groundwater Rights and Wells

The Utah Division of Water Rights classifies groundwater wells according to their use: domestic (drinking water), irrigation, stock watering, municipal, or recreational. The municipal classification indicates that the well is owned by a city or county for a variety of uses, including drinking water or agriculture. The Division of Water Rights tracks groundwater rights according to an inventoried water right number. Each water right number represents one or more actual groundwater wells. The approximate locations of wells or clusters of wells are shown in Figure 14-2 through Figure 14-4, Water Sources.

14.3.2.6 Drinking Water Sources

There are 22 groundwater wells and springs that provide drinking water within 0.5 mile of the Salt Lake County alternatives as shown in Table 14.3-3. There are no surface water sources for drinking water in the Salt Lake County portion of the water quality impact analysis area.

Table 14.3-3. Drinking Water Sources within 0.5 Mile of the Salt Lake County Alternatives

Water System Owner	Sources
Salt Lake County	
Granger-Hunter Improvement District	1
Kearns Improvement District	3
Kennecott-Copperton Concrete	1
Kennecott – Section 21	4
Magna Water Co. and Improvement District	5
Riverton City Water System	1
Rock Service	1
Taylorsville-Bennion Water Improvement District	2
West Jordan Water System	4
Total drinking water sources	**22**

Source: Jensen 2006

14.3.3 Resources in Utah County

14.3.3.1 Surface Waters and Beneficial-Use Classifications in the Utah Lake Watershed

The Utah Lake watershed includes all of the land that drains into Utah Lake and that portion of the Jordan River from the Utah Lake outlet downstream to the Jordan Narrows. Elevations in the Utah Lake watershed range between 4,475 feet at Jordan Narrows to 11,928 feet at Mount Nebo. Average annual precipitation is the same as that for the Jordan River watershed, ranging from 11.5 inches in the lower valley to over 50 inches in the highest mountain areas (Utah Division of Water Quality, no date).

Surface water provides 62% of the developed water supply in the Utah Lake watershed. Most of the developed water supply is used for agricultural irrigation. However, due to urban expansion, water is being transferred from agricultural to urban uses (Utah Division of Water Resources 1997b, 2-2, 2-3). Table 14.3-4 provides a summary of surface waters in the Utah Lake watershed and their beneficial-use classifications.

Table 14.3-4. Surface Waters and Beneficial Uses in the Utah County Portion of the Water Quality Impact Analysis Area

Watershed	Water Body[a]	Beneficial Uses
Utah Lake watershed	Dry Creek	2B (secondary contact), 3A (cold-water fish species), 4 (agriculture)
	American Fork River	2B (secondary contact), 3A (cold-water fish species), 4 (agriculture)
	Spring Creek	2B (secondary contact), 3A (cold-water fish species), 4 (agriculture)
	Jordan River	1C (drinking water), 2B (secondary contact), 3B (warm-water fish species), 4 (agriculture)
	Utah Lake	2B (secondary contact), 3B (warm-water fish species), 3D (waterfowl), 4 (agriculture)

[a] For the Utah County surface waters listed, the beneficial use includes the entire water body reach.

Source: UAC R317-2-13, Classification of Waters of the State, as in effect February 17, 2006

There are other creeks and canals in the Utah County portion of the water quality impact analysis area in addition to those shown above in Table 14.3-4. These creeks and canals, and any others that are not specifically designated in UAC R317-2-13, use the default beneficial-use classifications of 2B (secondary contact) and 3D (waterfowl) (UAC R317-2-13.14). The narrative standard also applies to these waters.

14.3.3.2 High-Quality Waters

There are no high-quality waters in the Utah County portion of the water quality impact analysis area (UAC R317-2-12, High-Quality Waters, as in effect May 10, 2007).

14.3.3.3 Impaired Waters

According to UDEQ, the major activities that cause water quality impacts to the Jordan River and Utah Lake are resource extraction, habitat modification, stream modification, agricultural activities, and urban stormwater runoff (Utah Division of Water Quality 2002, iv).

Utah Lake does not meet the numeric standards for beneficial-use classification 3B (warm-water species of game fish) due to high levels of total phosphorous and total dissolved solids (see Table 14.3-5). High levels of phosphorous can come from fertilizers, from sediments that have eroded from hillsides, or from sediments that have eroded from high-velocity streams. The Jordan River is not impaired in Utah County.

Table 14.3-5. Impaired Waters in the Utah County Portion of the Water Quality Impact Analysis Area

Watershed	Water Body	Impaired Beneficial Use	Standards Not Met
Utah Lake watershed	Utah Lake	3B (warm-water fish)	Total phosphorous, total dissolved solids

Source: Utah Division of Water Quality 2004, 29, 51

14.3.3.4 Groundwater Quality

Groundwater provides about 38% of the presently developed water supply in the Utah Lake watershed (Utah Division of Water Resources 1997b, 2-2). There are five groundwater subbasins in the Utah Lake groundwater basin. The groundwater subbasin that intersects the Mountain View Corridor alternatives is the Utah–Goshen Valley basin.

The groundwater quality of the Utah–Goshen Valley basin meets all state and federal standards for culinary use. The highest-quality groundwater is found nearest the major sources of recharge along the east side of the basin. Two areas in the basin have degraded water quality. One area begins along the northwest shore of Utah Lake and extends north along the Jordan River to the Jordan Narrows. The second area begins along the south shore of Utah Lake at Goshen Bay and extends south to the town of Goshen and Current Creek. In these areas, the groundwater is classified as slightly to moderately saline. The higher concentrations in these areas might be caused by saline water that rises along a north-south-trending fault (Utah Lake fault) in the area (Utah Division of Water Resources 1997b).

As in Salt Lake County, the Utah County groundwater in the water quality impact analysis area consists of a deeper confined aquifer and a shallow aquifer. The groundwater gradient moves generally south toward Utah Lake. Groundwater depths immediately north of Utah Lake are just below the surface, and several springs have been identified near the Pleasant Grove/Interstate 15 (I-15) interchange. Groundwater flows are also near the surface along the southern termini of American Fork River and Spring Creek.

According to the Utah Division of Drinking Water, there are no aquifers classified as protected in the Utah County portion of the water quality impact analysis area (Herbert 2004).

14.3.3.5 Groundwater Rights and Wells

As discussed in Section 14.3.2.5, Groundwater Rights and Wells, the Utah Division of Water Rights classifies groundwater wells according to their use. The approximate locations of wells or clusters of wells in Utah County are shown in Figure 14-5 through Figure 14-7, Water Sources.

14.3.3.6 Drinking Water Sources

There are 15 groundwater wells and springs that provide drinking water within 0.5 mile of the Utah County alternatives as shown in Table 14.3-6. There are no surface water sources for drinking water in the Utah County portion of the water quality impact analysis area.

Table 14.3-6. Drinking Water Sources within 0.5 Mile of the Utah County Alternatives

Water System Owner	Sources
Utah County	
Barnes Bullets	1
Camp Williams	6
Jordan Valley Water Conservancy District	1
City of Saratoga Springs	5
Webb Well Water Users	2
Total drinking water sources	**15**

Source: Jensen 2006

14.4 Environmental Consequences

This section discusses the expected water quality impacts to surface water and groundwater from the No-Action Alternative and each of the action alternatives.

14.4.1 Analysis Methods and General Impact Evaluation

14.4.1.1 Surface Waters

In general, impacts to surface waters from each alternative were evaluated based on the following data:

- The amount of impervious (paved) area added
- The number of stream crossings
- An in-stream numeric analysis of typical roadway runoff pollutants to determine if numeric water quality standards would be exceeded
- Potential to affect the impaired 303(d)-listed waters in the vicinity (Jordan River and Utah Lake)
- Potential to affect the surface water's beneficial-use classification

14.4.1.2 Impervious Area Added

Assuming that the MVC project's impacts on water quality are not mitigated, the additional impervious area from roadway pavement can affect water quality in several ways. These include:

- Increased volume of stormwater runoff discharged into streams, which can increase the velocity of the water in the stream. Higher water velocities increase the potential for erosion, and erosion increases the concentration of total dissolved solids (TDS) and total suspended solids (TSS) in the stream.
- Increased paved area which requires more de-icing chemicals, which can increase TDS levels.
- Increased automobile traffic, which can increase several automobile-related pollutants, primarily copper, lead, and zinc.
- Reduced infiltration of stormwater into the soil. Infiltration treats and improves water quality because microbes in the soil help filter pollutants and because particulates settle out of the stormwater into the soil.

14.4.1.3 Stream Crossings

For the analysis, the number of stream crossings was counted for each MVC alternative. A stream crossing is a location where a road crosses a stream, river, or canal. Stream crossings require structures such as bridges or culverts to allow the water to pass under the road. Depending on the design and construction methods used for the MVC project, the encroachment of the roadway into a stream and the culverts and bridges at stream crossings could adversely affect a stream's natural flow pattern, profile, channel stability, aquatic habitats, streambank vegetation, or riparian habitats.

Building a roadway farther into a stream can also increase the stream's velocity and can cause downstream erosion. The closer the roadway is to a stream, the greater is the potential for water to run off the road without undergoing water quality treatment before it enters the stream. Types of water quality treatment include detention basins, vegetated swales or bioswales, aeration, or reaction to sunlight. The greater the number of stream crossings, the more quickly the roadway runoff can enter the stream if it is not detained.

14.4.1.4 Contaminants in Stormwater from the Mountain View Corridor

To evaluate impacts from the MVC alternatives, typical contaminants from highway runoff were considered. These contaminants are listed in Table 14.4-1 below.

Four highway runoff contaminants were evaluated using different methods of numeric analysis. Concentrations of copper, lead, and zinc were modeled using the Federal Highway Administration's (FHWA) numeric water quality model (see Section 14.4.1.5, FHWA Numeric Analysis). Concentrations of TDS were assessed by modeling the concentrations of de-icing chemicals and by using event mean concentration (EMC) values from the Stormwater Quality Data Technical Report prepared for Salt Lake County (Salt Lake County 2000).

Table 14.4-1. Typical Highway Runoff Contaminants

Contaminant	Sources
Bromide	Exhaust
Cadmium	Tire wear, herbicide application
Chloride	De-icing salts
Chromium	Metal plating, engine parts, brake lining wear
Copper	Metal plating, bearing wear, engine parts, brake lining wear, fungicide and insecticide use
Cyanide	Anticake compound used to keep de-icing salts granular
Iron	Auto body rust, steel highway structures, engine parts
Lead	Tire wear, lubricating oil and grease, bearing wear, atmospheric deposition
Manganese	Engine parts
Nickel	Diesel fuel and gasoline, lubricating oil, metal plating, brake lining wear, asphalt paving
Nitrogen, phosphorous	Atmosphere, sediments
Particulates (sediments or TSS)	Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance
Pathogenic bacteria	Soil, litter, bird droppings, trucks hauling livestock/stockyard waste
Polychlorinated biphenyls (PCBs)	Spraying of highway rights-of-way, atmospheric deposition, PCB catalyst in synthetic tires
Petroleum	Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate
Rubber	Tire wear
Sodium, calcium	De-icing salts, grease
Sulfate	Roadway beds, fuel, de-icing salts
Total dissolved solids (TDS)	De-icing salts, vehicle deposits, pavement wear
Zinc	Tire wear, motor oil, grease

Source: FHWA 1996, 34

14.4.1.5 FHWA Numeric Analysis

FHWA's numeric water quality model was used to quantify the impacts of metals in the runoff from the Mountain View Corridor on surrounding water quality. The model is explained in two FHWA research documents: FHWA-RD-88-006, *Pollutant Loadings and Impacts from Highway Stormwater Runoff* (FHWA 1990), and FHWA-RD-96-095, *Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff* (FHWA 1996).

The available data indicate that the heavy metals considered in this analysis (copper, lead, and zinc) are the dominant toxic pollutants contributed by highway stormwater runoff. The procedure used for this analysis is a probabilistic dilution model developed and applied in EPA's Nationwide Urban Runoff Program and reviewed and approved by EPA's Science Advisory Board. The model allows the user to determine how often a certain concentration of a pollutant will occur in a stream given the variable and intermittent discharges of water that are produced by stormwater runoff. The model computes the highest in-stream concentration of the pollutant that is expected to occur over a 3-year period after the runoff is mixed with and diluted by the water in the stream (FHWA 1990, 1–2.)

Flow rates for the modeled streams were determined from either U.S. Geological Survey gage data (in the case of the Jordan River and the American Fork River) or hydrologic analysis (in the case of Barney's Creek).

The analysis assumes that the concentrations of each pollutant of concern in the stormwater runoff are similar to the EMCs as analyzed from samples collected during storm events for various locations in Salt Lake County from 1992 to June 2000. These samples were taken as part of the Utah Pollutant Discharge Elimination System permit requirements for Salt Lake County, the Utah Department of Transportation (UDOT) Region 2, and Salt Lake City. The roadway sampled for the report is Interstate 215 (I-215) between the Jordan River and a location about 1,700 feet east of Fashion Boulevard (about 300 East) (Salt Lake County 2000). These EMCs were used since they were more site-specific than the average values suggested by the numeric analysis documentation (FHWA 1996). The values used in the analysis are shown in Table 14.4-2.

Table 14.4-2. Event Mean Concentrations During Sampled Storm Events

Pollutant	EMC (mg/L)
Total copper	0.039
Total lead	0.031
Total zinc	0.181
TSS	116
TDS (sampled during April, May, June, September, and October)	581 (storm composite)

EMCs are an average over 5 years from 1995 to 2000.

mg/L = milligrams per liter

Source: Salt Lake County 2000

Runoff from the MVC action alternatives would undergo water treatment primarily through detention basins. The pollutant removal rates of detention basins in the FHWA document (FHWA 1996) were replaced with the more conservative removal rates recommended in UDOT's literature (UDOT 2003) (see Table 14.4-3).

Table 14.4-3. Percentages of Pollutants Removed by Detention Ponds

Pollutant	Percent of Pollutant Removed
Copper	44%[a]
Lead	69%[b]
Zinc	59%[b]

[a] Source: FHWA 1996, 72

[b] Source: UDOT 2003, 30 (A removal percentage for copper was not provided in this document.)

Since the 5600 West Transit Alternative would be placed in the existing 5600 West right-of-way, a conservative modeling assumption is that the water quality of stormwater runoff for the transit alternatives would be considered similar to the highway pollutants mentioned in Table 14.4-3 above which would have similar pollutants as the 5600 West roadway.

14.4.1.6 TDS Analysis

UDOT applies salt on its roads to reduce ice and improve traction during heavy snowfall. UDOT applies slightly more salt along the Wasatch Front than in the rest of the state. Along the Wasatch Front, UDOT uses two different methods to apply salt for a winter storm (Bernhard 2005). These methods are based on forecasting and nowcasting (forecasting at the moment when the storm begins) by the UDOT Meteorological Center and meteorological consultants as well as through local observations from UDOT maintenance personnel and meteorologists. Based on these predictions, salting trucks are mobilized and salt is applied as follows:

- From 24 hours up to the actual start of the storm, 15 gallons of 23% salt brine per lane-mile are applied.
- When the storm begins, a mixture of 4 gallons of 23% salt brine and 250 pounds of common salt per lane-mile is applied.

Not all of the salt applied to the road reaches surface water. Some of the salt is precipitated onto the road surface, and some is dissolved in the runoff from melted snow and ice. Much of the granular salt is redeposited along the road shoulders, and some of the dissolved salts from these deposits infiltrate into the roadside soils with the runoff. Some salt could run off into adjacent streams as the snow melts. Dissolved solids are typically measured in the form of total dissolved solids (TDS).

Table 14.4-4 shows the calculation for TDS concentrations in snowmelt due to UDOT's anti-icing operations assuming that 100% of the salt applied is immediately dissolved and runs off the right-of-way.

Table 14.4-4. Approximate TDS in Snowmelt Runoff Due to Anti-icing Operations

Input or Standards	Description	Assumptions or Results
Storm event	Total snowfall depth	6 inches
Anti-icing	Number of brine applications	1
	Number of road salt and brine applications	2
Roadway data	Total inside paved shoulder width	5 feet
	Total number of traffic lanes and auxiliary lanes	4 lanes
	Total outside paved shoulder width	12 feet
	Total tributary vegetated width within right-of-way	20 feet
Salt applied	Salt quantity due to brine	3.69 ft^3/mi
	Salt quantity due to spreader	15.49 ft^3/mi
	Total salt applied	19.18 ft^3/mi
Runoff	Runoff from snowmelt	16,764 ft^3/mi
Results	**Approximate TDS in snowmelt runoff due to anti-icing operations**	**1,034 ppm**
Water quality standards	Utah primary drinking water standard for TDS	2,000 ppm
	Utah water quality standards for TDS	
	Irrigation	1,200 ppm
	Stock watering	2,000 ppm
	EPA secondary standard for TDS	500 mg/L

Shaded cells are required input variables.

ft^3/mi = cubic feet per mile

ppm = parts per million

mg/L = milligrams per liter

Assumptions:

- Water content of snow is 10%.
- Brine is applied once per storm at a rate of 30 gallons per lane-mile with a salt concentration of 23%.
- Each application of salt consists of 250 pounds per lane-mile, plus 4 gallons per lane-mile of 23% salt brine.
- Salt is spread at the beginning of a snowstorm and again for every 3 inches of additional snowfall.
- Brine and salt are applied to traffic lanes and auxiliary lanes only.
- Runoff coefficient for pavement = 0.9.
- Runoff coefficient for vegetated right-of-way = 0.25.
- Specific gravity (unit weight of salt) = 2.165 (135 pounds per cubic foot); dry bulk density of rock salt for de-icing = 80 pounds per cubic foot.
- One cubic foot of rock salt is approximately 60% salt by volume.

These assumptions are based on numbers from Lynn Bernhard of UDOT Maintenance (Bernhard 2005; Patterson 2005) specifically for the Wasatch Front.

The typical concentrations of TDS in highway runoff as sampled for highway projects are 581 mg/L (milligrams per liter). The location of this sampling was an outlet to the Jordan River at I-215 (Salt Lake County 2000). As shown above in Table 14.4-4, Approximate TDS in Snowmelt Runoff Due to Anti-icing Operations, the estimated TDS concentration was 1,034 ppm, which assumes that 100% of the salt is dissolved and runs off the roadway.

Both the modeled and observed concentrations of TDS taken from the Jordan River at I-215 are less than the Utah in-stream agricultural TDS standards of 1,200 mg/L for crop irrigation and 2,000 mg/L for stock watering.

The existing concentrations of TDS in the streams that were modeled are below the standards for their beneficial uses. Because UDOT expects to use similar de-icing methods on the MVC as the methods it uses on I-215, periodic increases in TDS levels in the receiving waters in the impact analysis area could be anticipated in the winter and early spring. The TDS standard applies to agricultural uses only. The majority of agricultural uses of water occur in the middle to late spring, summer, or fall. De-icing is typically not done during these periods. Consequently, any increases in TDS levels from de-icing would not occur when the majority of water for agriculture would be required. Most importantly, the Mountain View Corridor would not change the beneficial uses of streams in the impact analysis area as a result of an increase in TDS levels.

Impaired Waters

The expected impacts to surface water quality were assessed based on impacts to the streams and lakes in the impact analysis area. Of particular concern are those streams that are on the 303(d) list of “impaired” waters. Streams that are not on the 303(d) list can also experience water quality impacts. However, most of the streams in the impact analysis area are intermittent streams, so the focus of this evaluation is on those streams on the 303(d) list for which water quality data are available. The impaired waters in the impact analysis area are Utah Lake and the Jordan River (in the Salt Lake County segment only).

Beneficial-Use Classification

Impacts to the beneficial uses of water bodies in the impact analysis area were evaluated. Numeric water quality modeling was conducted for the MVC alternatives to determine if the beneficial-use classification for the streams identified above in Table 14.3-1, Surface Waters and Beneficial Uses in the Salt Lake County Portion of the Water Quality Impact Analysis Area, and Table 14.3-4, Surface Waters and Beneficial Uses in the Utah County Portion of the

Water Quality Impact Analysis Area, would be affected by runoff from the Mountain View Corridor.

14.4.1.7 Groundwater

In general, impacts to groundwater quality were evaluated for all alternatives based on their proximity to wells and their expected impacts on both the shallow and principal aquifers.

Impacts to Groundwater Quality

Some impacts to the shallow aquifer are anticipated as a result of the MVC alternatives, but the impact is not likely to reduce water quality because the quality of the water in the shallow aquifer is already generally poor and does not affect the quality of the water in the deeper aquifer. There would be no impacts to the recharge area of the deeper aquifer. The impact analysis area is a substantial distance away from the primary recharge areas, which are in the Oquirrh and Wasatch Mountains. If groundwater wells are affected, this would not necessarily affect the overall groundwater quality, but it would inconvenience users of groundwater when wells are relocated.

Impacts to Drinking Water Source Protection Zones and Other Wells

The impacts to drinking-water wells and other wells were assessed using geographic information system (GIS) software to calculate the distance from the wellhead to the MVC alternatives. The analysis evaluated both direct impacts and indirect impacts.

- Direct Impacts
    - For all wells, a direct impact would occur if an alternative's right-of-way would go over the wellhead.
    - For drinking water sources, a direct impact would occur if an alternative would encroach on drinking water source protection Zone 1, which is the area within a 100-foot radius of the wellhead.
- Indirect Impacts
    - For drinking water sources, an indirect impact would occur if an alternative's right-of-way is within 0.25 mile of a well.

If a well needs to be relocated, UDOT would either purchase the water right or the land associated with the water right or negotiate an agreement with the water right owner to replace the well. Impacts to drinking water sources caused by encroaching on wells and drinking water source protection zones are of some concern to the Utah Division of Drinking Water (Jensen 2006) but do not require a permit from the Division of Water Quality (Herbert 2004).

14.4.2 No-Action Alternative

Under the No-Action Alternative, the MVC project would not be built. Residential, commercial, and other development in the water quality impact analysis area will continue over the next 20 years and beyond. The need for transportation and related infrastructure, including roads, bridges, and culverts, will accompany this development. This will increase the amount of impervious area, change runoff characteristics, and potentially degrade water quality.

If the Mountain View Corridor project is not constructed, the primary highways through the MVC study area would continue to be I-15, I-80, I-215, Bangerter Highway, 5600 West, and State Route (SR) 201. Over time, traffic volumes and congestion will grow, and the amount of contaminants will increase above existing levels. The increased impervious area associated with development could also reduce recharge rates for groundwater and increase surface water contaminants.

The ongoing development that would occur under the No-Action Alternative could contribute to degradation of surface water quality and recharge areas for groundwater. If the groundwater recharge areas are degraded under this scenario, groundwater quality could also be affected.

14.4.3 Salt Lake County Alternatives

In Salt Lake County, two roadway alternatives and a transit alternative that would be implemented as part of the roadway alternatives are under consideration: the 5600 West Transit Alternative, the 5800 West Freeway Alternative, and the 7200 West Freeway Alternative. Under the 5600 West Transit Alternative, there is a dedicated right-of-way (ROW) option and a mixed-traffic option. In addition, a tolling option was considered for each freeway alternative. Impacts under each combination of alternatives and options are discussed in the following sections.

The greatest concern with regard to surface water in the Salt Lake County portion of the water quality impact analysis area is elevated temperature as identified in the Section 303(d) list for the Jordan River. Some possible causes of elevated water temperatures include the following:

1. Water sheet-flows off the road and picks up heat from the road surface before the surface of the roadway cools.
2. How turbid the water is (that is, how much sediment is in the water). Turbid water reflects less sunlight and absorbs more heat from the sun.
3. Streamside vegetation is cleared, which increases the amount of sunlight that can reach and warm the stream.
4. How deep the water is. Shallow water has a greater area that is exposed to sunlight than the same volume of deeper water. This increases the sun's ability to warm the water (Lake Superior Duluth Streams, no date).

It is expected that an increased amount of pavement would affect items 1, 2, and 3 above and could increase water temperatures. However, runoff water temperatures could be reduced by designing deep, shaded detention ponds to treat the runoff from the MVC. Detention basins also reduce runoff velocities into nearby water bodies by controlling water flow.

As stated in Section 14.3.2.3, Impaired Waters, the cause of the elevated temperatures in the Jordan River which are causing impairment of this water body is unknown. Overall, with the inclusion of mitigation measures such as detention ponds (which can cool the temperature of runoff), it is anticipated that the MVC action alternatives would have a minor impact on surface water temperatures because the amount of runoff is small in relation to the in-stream flow during and after a storm event.

14.4.3.1 5600 West Transit Alternative

5600 West Transit Alternative Impacts		
Water Quality Parameter	Dedicated Right-of-Way Option	Mixed-Traffic Option
Impervious area added	119 acres	117 acres
Stream crossings	7	7
Groundwater wells within right-of-way	35	43

As described in Chapter 2, Alternatives, two transit options are under consideration along 5600 West in Salt Lake County. One option, the Dedicated Right-of-Way Option, would incorporate a transit system running down the center of the roadway, and the other, the Mixed-Traffic Option, would incorporate a transit system running alongside the roadway.

5600 West Transit Alternative with Dedicated Right-of-Way Transit Option

Surface Water Impacts

Impervious Area Added. Because the Dedicated Right-of-Way Transit Option would mostly run along the existing 5600 West alignment, a small amount of new pavement would be required for the transit stations and park-and-ride lots. For the Dedicated Right-of-Way Transit Option, the additional (new) impervious area would be 119 acres. The detention basins proposed as part of the project would be used to capture runoff from the roadway surface and reduce the flow rate of the runoff into adjacent water bodies and minimize erosion.

Stream Crossings. The Dedicated Right-of-Way Transit Option would cross seven streams. Because most of this transit option would be within the existing 5600 West roadway, drainage structures are already in place for some of the identified crossings. Specifically, structures are already in place at three streams—Clay Hollow Drainage, Barney’s Creek, and Barney’s Wash—though these structures might need to be modified. New structures would be required for crossings of the Surplus Canal, Bingham Creek, Midas Creek, and Copper Creek. Adding culverts could increase the stream velocities, which would increase the potential for downstream erosion and lower water quality. Table 14.4-5 below shows the number of stream crossings for each alternative in Salt Lake County.

Table 14.4-5. Stream Crossings in Salt Lake County

Stream or Water Body	Crossings by Alternative[a]			
	5600 West Transit – Dedicated ROW	5600 West Transit – Mixed Traffic	5800 West Freeway	7200 West Freeway
Surplus Canal	T	T	NA	NA
Lee Creek	NA	NA	T[b]	T
Coon and Harker's Canyon Creeks	NA	NA	NA	NA
Dry Wash	NA	NA	T	T
Clay Hollow Drainage	T	T	T	T
Unnamed Creek	NA	NA	T	T
Barney's Creek	T	T	T	T
Barney's Wash	T	T	T	T
Bingham Creek	T	T	T	T
Midas Creek	T	T	T	T
Copper Creek	T	T	NA	NA
Butterfield Creek	NA	NA	NA	NA
Rose Creek	NA	NA	T	T
Juniper Canyon Drainage	NA	NA	T	T
Wood Hollow Drainage	NA	NA	T	T
Beef Hollow Drainage	NA	NA	T	T
Total stream crossings	**7**	**7**	**12**	**12**

[a] T = Transverse crossing (creek or stream crosses the MVC alternative); NA = Not applicable.
[b] Transverse crossing located on 2100 South intersection footprint rather than on the main roadway.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. Because relatively small amounts of impervious surface would be added for both transit options, the numeric water quality analysis of impacts to surface waters from the combination of a freeway and transit alternative is presented in Section 14.4.3.2 for the 5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters and beneficial uses from the Dedicated Right-of-Way Transit Option by itself.

Groundwater Impacts

Groundwater Quality. All of the MVC action alternatives would likely affect the water quality of the shallow aquifer because some runoff from the roadway would infiltrate the aquifer, whose water is already of poor quality. The deeper principal aquifer, which provides much of the drinking water, would not be affected because it is mostly outside the impact analysis area on the east side of the Salt Lake Valley.

Groundwater Flow. Within Salt Lake County, the groundwater elevation is highest near I-80 at about 14 feet below the ground surface, and the flow is north toward the Great Salt Lake. Currently, I-80 does not impede the flow of the shallow aquifer even though the highway is perpendicular to the flow. Therefore, UDOT does not expect that a north-south transit option would impede the flow of groundwater in the shallow aquifer.

Groundwater Wells. There are 299 wells within 0.25 mile of the Dedicated Right-of-Way Transit Option. This alternative would affect 35 groundwater wells within the right-of-way, some of which are used for drinking water. If a well needs to be relocated, UDOT would either purchase the water right and the land associated with the right or negotiate an agreement with the water right owner to replace the well.

Six drinking water wells are within 0.25 mile of the Dedicated Right-of-Way Transit Option. Currently, there is one drinking water well (West Jordan Water System) within the footprint of this alternative.

5600 West Transit Alternative with Mixed-Traffic Transit Option

The Mixed-Traffic Transit Option would require 117 acres of new impervious area, which is slightly less than for the Dedicated Right-of-Way Transit Option (119 acres). Because the alignments for the two transit options are similar, and because the amount of impervious area would be similar, the impacts to water quality from the Mixed-Traffic Transit Option would be the same as those from the Dedicated Right-of-Way Transit Option. Forty-three wells (non–drinking water) are within the right-of-way of the Mixed-Traffic Transit Option. One drinking water well would be directly affected.

14.4.3.2 5800 West Freeway Alternative

As described in Chapter 2, Alternatives, this alternative would consist of a freeway extending from I-80 to the Utah County line.

5800 West Freeway Alternative Impacts

Water Quality Parameter	Impacts
Impervious area added	662 acres
Stream crossings	12
Groundwater wells within right-of-way	137

Surface Water Impacts

Impervious Area Added. The 5800 West Freeway Alternative would require 662 acres of new impervious area. The detention basins proposed as part of the project would be used to capture runoff from the roadway surface, which would reduce the flow rate of the runoff into adjacent water bodies and minimize erosion.

Stream Crossings. The 5800 West Freeway Alternative would cross 12 streams: Lee Creek, Dry Wash, Clay Hollow Drainage, Unnamed Creek, Barney's Creek, Barney's Wash, Bingham Creek, Midas Creek, Rose Creek, Juniper Canyon Drainage, Wood Hollow Drainage, and Beef Hollow Drainage. Of these crossings, only two (Lee Creek and Rose Creek) have existing drainage structures at the location of the Mountain View Corridor crossing. These structures would likely be replaced under this alternative. The remaining 10 crossings would require new structures.

Numeric Analysis. Barney's Creek, a small drainage near the 5800 West Freeway Alternative, was selected for the numeric analysis because it could receive runoff from the 5800 West Freeway Alternative alignment. In general, the greater the runoff volume and the smaller the water body, the greater the potential impact on water quality. Accordingly, the numeric results for Barney's Creek should be conservative compared to those for the other, larger creeks in the MVC study area. Barney's Creek was also selected because existing water quality data were available through EPA's water quality database.

Table 14.4-6 shows the primary pollutants that could affect the beneficial uses of water bodies in the Salt Lake County portion of the water quality impact analysis area and the associated standards for each pollutant.

Table 14.4-6. Beneficial Uses and Primary Pollutants in the Salt Lake County Portion of the Impact Analysis Area

	Primary Pollutants and Associated UAC R317 Standards							
Beneficial Use	**BOD5**	***E. coli***	**pH**	**Copper (mg/L)**	**Lead (mg/L)**	**Zinc (mg/L)**	**TDS – Irrigation (mg/L)**	**TDS – Stock Watering (mg/L)**
2B (secondary contact)	x	x	6.5–9.0					
3A (cold-water fish)	x			0.013	0.065	0.120		
3B (warm-water fish)	x			0.013	0.065	0.120		
3D (waterfowl)	x			0.013	0.065	0.120		
4 (agriculture)	x						1,200	2,000

BOD = biological oxygen demand
Source: UAC R317.2

Since BOD5 and *E. coli* are not common constituents of highway stormwater runoff, UDOT does not expect the Mountain View Corridor to affect the secondary contact beneficial use (2B).

Table 14.4-7 below shows the modeled in-stream concentrations of copper, lead, zinc, and TDS for Barney's Creek as a result of the 5800 West Freeway Alternative with Dedicated Right-of-Way Transit Option. This alternative combination was selected for modeling since it represents the worst-case water quality scenario for the Salt Lake County alternatives. Table 14.4-7 shows that the modeled in-stream pollutant concentrations would be below the UAC R317 Standard of Quality for Waters of the State for the pollutants analyzed. The analysis assumes that stormwater runoff would pass through a detention basin before being discharged to the creek.

Table 14.4-7. Modeled Water Quality in Barney's Creek under the 5800 West Freeway Alternative with Dedicated Right-of-Way Transit Option

Pollutant of Concern	Modeled In-Stream 3-Year Concentration	UAC R317 Standard[a]
Copper	0.009 mg/L[b]	0.013 mg/L
Lead	0.001 mg/L[b]	0.065 mg/L
Zinc	0.031 mg/L[b]	0.120 mg/L
TDS – Irrigation	581 mg/L[c]	1,200 mg/L
TDS – Stock watering	581 mg/L[c]	2,000 mg/L

[a] The UAC R317 standard is the highest in-stream concentration of the pollutant that can occur over a 3-year period.

[b] This is the highest in-stream concentration of the pollutant that is expected to occur over a 3-year period according to FHWA's modeling (see Section 14.4.1.5, FHWA Numeric Analysis).

[c] This is the concentration of TDS in highway runoff from the Stormwater Quality Data Technical Report (Salt Lake County 2000).

Impacts to Impaired Waters and Beneficial Uses. The Section 303(d) list includes the Jordan River as an "impaired" water due to elevated temperature. The increased amount of pavement due to the 5800 West Freeway Alternative could allow water to pick up heat from the road, make the water more turbid (dirty) which allows water to absorb more heat, and require the clearing of shade-producing vegetation. All of these impacts from the project could increase the temperature of the Jordan River. However, because the alternative would include measures such as detention ponds, which can cool the temperature of runoff, it is anticipated that all of the MVC action alternatives would have minor impacts on surface water temperatures. Detention basins would also reduce the amount of sediment that enters adjacent waters.

Groundwater Impacts

Groundwater Quality. As noted in Section 14.4.3.1, 5600 West Transit Alternative, all of the MVC action alternatives would likely affect the water quality of the shallow aquifer, which is already of poor quality. The deeper principal aquifer, which provides much of the drinking water, would not be affected because the recharge areas are mostly outside the impact analysis area.

Groundwater Flow. Within Salt Lake County, the groundwater elevation is highest near I-80 at about 14 feet below the ground surface, and the flow is north toward the Great Salt Lake. Currently, I-80 does not impede the flow of the shallow aquifer even though the highway is perpendicular to the flow. This is a result of the upward gradient in this area. Therefore, it is not expected that the north-south 5800 West Freeway Alternative would impede the flow of groundwater in the shallow aquifer.

Groundwater Wells. There are 597 wells within 0.25 mile of the right-of-way of this alternative, 14 of which are drinking water wells. There are 137 wells within the right-of-way of this alternative. However, none of these wells are used for drinking water. UDOT would mitigate the impacts to any affected wells within the right-of-way (see the section titled Groundwater Wells on page 14-25).

Combined Impacts of 5800 West Freeway and 5600 West Transit Alternatives

The 5800 West Freeway Alternative would be implemented with one of the two 5600 West Transit Alternative options.

Combined Impacts of 5800 West Freeway and 5600 West Transit Alternatives

Water Quality Parameter	Dedicated Right-of-Way Option	Mixed-Traffic Option
Impervious area added	781 acres	779 acres
Stream crossings	19	19
Groundwater wells within right-of-way	172	180

5800 West Freeway Alternative with Dedicated Right-of-Way Transit Option

Surface Water Impacts

Impervious Area Added. The combined 5800 West Freeway Alternative with Dedicated Right-of-Way Transit Option would require 781 acres of new impervious area.

Stream Crossings. The total number of stream crossings associated with each of the Salt Lake County alternatives is shown above in Table 14.4-5, Stream Crossings in Salt Lake County. As shown in the table, the 5800 West Freeway Alternative would result in 12 stream crossings that would require two replacement structures and 10 new structures. The Dedicated Right-of-Way Transit Option would result in seven stream crossings, of which three have existing structures. The combined impacts of the 5800 West Freeway Alternative and the Dedicated Right-of-Way Transit Option would be 19 stream crossings.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The numeric analysis for the combined impacts of the 5800 West Freeway Alternative and the Dedicated Right-of-Way Transit Option is the same as for the

5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Flow. The impacts to groundwater flow from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Wells. There are 18 drinking water wells within 0.25 mile of the 5800 West Freeway Alternative and the Dedicated Right-of-Way Transit Option (two wells are common to both alternatives). There is one drinking water well within the transit alignment footprint (right-of-way) that would need to be relocated.

5800 West Freeway Alternative with Mixed-Traffic Transit Option

Surface Water Impacts

Impervious Area Added. The combined 5800 West Freeway Alternative with Mixed-Traffic Transit Option would require 779 acres of new impervious area.

Stream Crossings. As shown above in Table 14.4-5, Stream Crossings in Salt Lake County, the Mixed-Traffic Transit Option and the Dedicated Right-of-Way Transit Option would have the same number of stream crossings (19 total stream crossings). Therefore, the combined impacts of the 5800 West Freeway Alternative and the Mixed-Traffic Transit Option would be the same as those from the combined 5800 West Freeway Alternative and the Dedicated Right-of-Way Transit Option.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The numeric analysis for the combined impacts of the 5800 West Freeway Alternative and the Mixed-Traffic Transit Option is the same as for the 5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Flow. The impacts to groundwater flow from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Wells. The impacts to drinking water wells would be the same as the combined impacts from the 5800 West Freeway Alternative and the Dedicated Right-of-Way Transit Option.

5800 West Freeway Alternative with Tolling Option

The 5800 West Freeway Alternative with Tolling Option would follow the same alignment and would have the same footprint as the 5800 West Freeway Alternative, so the impacts to water quality from the Tolling Option would be the same as those from the non-tolled alternative.

14.4.3.3 7200 West Freeway Alternative

As described in Chapter 2, Alternatives, this alternative would consist of a freeway extending from I-80 to the Utah County line.

7200 West Freeway Alternative Impacts	
Water Quality Parameter	**Impacts**
Impervious area added	573 acres
Stream crossings	12
Groundwater wells within right-of-way	112

Surface Water Impacts

Impervious Area Added. The 7200 West Freeway Alternative would require less new impervious area than the 5800 West Freeway Alternative because of the smaller collector-distributor system of on ramps and off ramps. The 7200 West Freeway Alternative would require 573 acres of additional impervious area. However, the 7200 West Freeway Alternative is closer to the Great Salt Lake and passes through more of the wetlands near the Lee Kay Center for Hunter Education and so has the potential to cause more water quality impacts.

Stream Crossings. The 7200 West Freeway Alternative would cross the same 12 streams as the 5800 West Freeway Alternative. For the 7200 West Freeway Alternative, 11 of the crossings would require new drainage structures. There is one existing crossing, but it would likely need to be replaced or modified.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The impacts to surface water would be the same as those from the 5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from the 7200 West Freeway Alternative would be the same as those from the 5800 West Freeway Alternative.

Groundwater Flow. The impacts to groundwater flow from the 7200 West Freeway Alternative would be the same as those from the 5800 West Freeway Alternative.

Groundwater Wells. There are 926 wells within 0.25 mile of the right-of-way of this alternative. Of these wells, 12 are drinking water wells. There are 112 wells within the right-of-way, with one being a drinking water well (Kennecott – Section 21 Well). UDOT would mitigate the impacts to any affected wells within the right-of-way (see the section titled Groundwater Wells on page 14-25).

Combined Impacts of 7200 West Freeway and 5600 West Transit Alternatives

As with the 5800 West Freeway Alternative, the 7200 West Freeway Alternative would be implemented with one of the two 5600 West Transit Alternative options.

Combined Impacts of 7200 West Freeway and 5600 West Transit Alternatives

Water Quality Parameter	Dedicated Right-of-Way Option	Mixed-Traffic Option
Impervious area added	692 acres	690 acres
Stream crossings	19	19
Groundwater wells within right-of-way	147	155

7200 West Freeway Alternative with Dedicated Right-of-Way Transit Option

Surface Water Impacts

Impervious Area Added. The combined 7200 West Freeway Alternative with Dedicated Right-of-Way Transit Option would require 692 acres of new impervious area.

Stream Crossings. The combined 7200 West Freeway Alternative with Dedicated Right-of-Way Transit Option would cross 19 streams.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The impacts to surface water would be the same as those from the 5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from the combined alternatives would be the same as those from the 5800 West Freeway Alternative with Dedicated Right-of-Way Transit Option.

Groundwater Flow. The impacts to groundwater flow from the combined alternatives would be the same as those from the 5800 West Freeway Alternative.

Groundwater Wells. There are 147 wells with the right-of-way for this alternative combination. There are 16 drinking water wells within 0.25 mile of the 7200 West Freeway Alternative with Dedicated Right-of-Way Transit Option (two wells are common to both alternatives). This combination would require the relocation of two drinking water wells within the right-of-way.

7200 West Freeway Alternative with Mixed-Traffic Transit Option

Surface Water Impacts

Impervious Area Added. The combined 7200 West Freeway Alternative with Mixed-Traffic Transit Option would require 690 acres of new impervious area.

Stream Crossings. The combined alternatives would cross 19 streams.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The impacts to surface water would be the same as those from the 5800 West Freeway Alternative. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Flow. The impacts to groundwater flow from the combined alternatives would be the same as those from the 5800 West Freeway Alternative by itself.

Groundwater Wells. There are 155 wells with the right-of-way for this alternative combination. The impacts to drinking water wells would be the same as the combined impacts from the 7200 West Freeway Alternative and the Dedicated Right-of-Way Transit Option.

7200 West Freeway Alternative with Tolling Option

The 7200 West Freeway Alternative with Tolling Option would follow the same alignment and would have the same footprint as the 7200 West Freeway Alternative, so the impacts to water quality from the Tolling Option would be the same as those from the non-tolled alternative.

14.4.3.4 Summary of Water Quality Impacts from the Salt Lake County Alternatives

Table 14.4-8 summarizes the impacts to impervious area, stream crossings, and wells from the Salt Lake County alternatives.

Table 14.4-8. Summary of Water Quality Impacts from the Salt Lake County Alternatives

			Drinking Water Wells		All Wells	
Alternative	Additional Impervious Area	Stream Crossings	Within Right-of-Way	Within 0.25 Mile	Within Right-of-Way	Within 0.25 Mile
5600 West Transit – Dedicated Right-of-Way	119 acres	7	1	6	35	299
5600 West Transit – Mixed Traffic	117 acres	7	1	6	43	297
5800 West Freeway	662 acres	12	0	14	137	597
7200 West Freeway	573 acres	12	1	12	112	926

14.4.4 Utah County Alternatives

In Utah County, three alternatives are under consideration: the Southern Freeway Alternative, the 2100 North Freeway Alternative, and the Arterials Alternative. In addition, a tolling option was evaluated for each Utah County alternative. Impacts under each combination of alternatives and options are discussed in the following sections.

14.4.4.1 Surface Water Pollutants of Concern in Utah Lake

The primary pollutants of concern for Utah Lake are TDS and phosphorous. TSS was also chosen as a pollutant of concern because it can indicate high phosphorous. Together, TSS and TDS are pollutants of concern because they are common contaminants in highway runoff and because there are already high phosphorous (TSS) and TDS levels in the streams that would be affected by the project. Though high phosphorous levels are generally correlated with high sediment (TSS) levels, Utah Lake does meet the TSS standards.

Another source of phosphorous is roadside fertilizers. However, UDOT does not expect that any roadside fertilizers would be used on the Mountain View Corridor (Bickford 2005).

Metals were not identified by the agencies as pollutants of concern, but measures to reduce TSS and TDS concentrations would also reduce metals concentrations. The agencies that were consulted for this chapter are UDOT and the Utah Department of Natural Resources. The primary concern of the Department of Natural Resources was that project requirements meet the general requirements for construction and dewatering, which would be stated in the Utah Pollutant Discharge Elimination System permit for the MVC project.

Phosphorous

Phosphorous can come from either total suspended solids or from direct application of phosphorus, usually in the form of fertilizer.

Two main sources of sediment loading are anticipated for the MVC that could also contribute phosphorous. Concentrated flows from culverts passing under the roadway could increase velocities, thereby mobilizing more sediments. Roadway fill sections with steep slopes could also increase velocities of runoff and erode roadside soils and mobilize sediments.

As shown above in Table 14.4-1, Typical Highway Runoff Contaminants, TSS is present in highway runoff from pavement wear, vehicles, the atmosphere, maintenance, snow/ice abrasives, and sediment disturbance.

Total Dissolved Solids

The water quality agencies identified TDS as a pollutant of concern for the MVC project. As shown above in Table 14.4-1, Typical Highway Runoff Contaminants, TDS is present in highway runoff from de-icing salts, vehicle deposits, and pavement wear. Disturbed sediments caused by erosion can also contribute to TDS.

De-icers and Total Dissolved Solids

UDOT anticipates using salt to remove ice on the roadway surface of the Mountain View Corridor (Bernhard 2005). UDEQ does not have numeric in-stream standards for salt, such as salinity or sodium concentration limits. Salt contributes to TDS concentrations in receiving waters in the form of dissolved sodium and other ions.

Not all of the salt applied to the road reaches surface water. Some of the salt is absorbed into the road surface, and some is dissolved in the runoff from melted snow and ice. Much of the salt is redeposited along the road shoulders, and some of the dissolved salts from these deposits infiltrate into the roadside soils with the runoff. Some salt could run off into adjacent streams as the snow melts. For more information about UDOT's practices regarding salt, see Section 14.4.1.6, TDS Analysis.

14.4.4.2 Southern Freeway Alternative

As described in Chapter 2, Alternatives, this alternative would consist of a freeway extending from the Utah County line to I-15 at Lindon.

Southern Freeway Alternative Impacts	
Water Quality Parameter	**Impacts**
Impervious area added	329 acres
Stream crossings	4
Groundwater wells within right-of-way	140

Surface Water Impacts

Impervious Area Added. The Southern Freeway Alternative would require 329 acres of new impervious area. The detention basins proposed as part of the project would be used to capture runoff from the roadway surface, which would reduce the flow rate of the runoff into adjacent water bodies and minimize erosion.

Stream Crossings. The Southern Freeway Alternative would cross four streams: Jordan River, Dry Creek, Spring Creek, and American Fork River (see Table 14.4-9).

Table 14.4-9. Stream Crossings in Utah County

Stream/ Water Body and Roadway	Crossings by Alternative[a]		
	Southern Freeway	**2100 North Freeway**	**Arterials**
Jordan River			
Porter Rockwell	NA	NA	T
2100 North	NA	T	T
1900 South	T	NA	T
Dry Creek	T	NA	T
Spring Creek	T	NA	T
American Fork River	T	NA	T
Total stream crossings	**4**	**1**	**6**

[a] T = Transverse crossing (creek or stream crosses the MVC alternative); NA = Not applicable.

Numeric Analysis. The American Fork River was selected for the numeric analysis because existing water quality data were available through EPA's water quality database. In addition, the numeric analysis for the American Fork River provides a worst-case scenario for impacts to water quality because it is smaller than other streams in Utah County such as the Jordan River. A numeric analysis is provided below for metals and TDS in the American Fork River. The analysis assumes that runoff would pass through a detention basin before being discharged.

Metals. Table 14.4-10 shows that the modeled in-stream concentrations of copper, lead, and zinc would be at or below the UAC R317 Standard of Quality for Waters of the State. The results of this analysis could be applied to the Jordan River for this alternative as the American Fork River provides a worst-case scenario given the smaller water body.

TDS. The analysis for TDS for the Salt Lake County alternatives also applies for the Utah County alternatives and shows that concentrations of TDS would be less than the TDS standard for the beneficial uses in Utah Lake.

Table 14.4-10. Modeled Water Quality in the American Fork River under the Southern Freeway Alternative

Pollutant of Concern	Modeled In-stream 3-Year Concentration	UAC R317 Standard[a]
Copper	0.013 mg/L[b]	0.013 mg/L
Lead	0.001 mg/L[b]	0.065 mg/L
Zinc	0.047 mg/L[b]	0.120 mg/L
TDS – Irrigation	581 mg/L[c]	1,200 mg/L
TDS – Stock watering	581 mg/L[c]	2,000 mg/L

[a] The UAC R317 standard is the highest in-stream concentration of the pollutant that can occur over a 3-year period.

[b] This is the highest in-stream concentration of the pollutant that is expected to occur over a 3-year period according to FHWA's modeling (see Section 14.4.1.5, FHWA Numeric Analysis).

[c] This is the concentration of TDS in highway runoff from the Stormwater Quality Data Technical Report (Salt Lake County 2000).

Impacts to Impaired Waters and Beneficial Uses. The numeric analysis shows that there would be no change to impaired waters or effects on beneficial uses. Though the copper concentration would match the UAC R317.2 standard, this concentration is a value that is statistically predicted to occur once every 3 years, so the copper concentration is expected to match the state standard only once every 3 years. At all other times, the copper concentration would be below the UAC R317.2 standard.

Groundwater Impacts

Groundwater Quality. The Southern Freeway Alternative would likely affect the water quality of the shallow aquifer, which is already of poor quality. The deeper principal aquifer, which provides much of the drinking water, would not be affected because it is mostly outside the impact analysis area.

Groundwater Flow. Within Utah County, the groundwater flow is near the surface just north of Utah Lake in American Fork and Lehi. The Southern Freeway Alternative would perpendicularly cross the groundwater flow. In areas of shallow groundwater, the proposed roadway embankments could compact the underlying soils and alter the groundwater flow. During the final design phase of the project, more detailed geotechnical evaluation and analysis would be required. At that time, UDOT would determine the impacts to the groundwater level from embankment fill, as well as appropriate mitigation measures. If groundwater is drawn to the surface by the project, flow toward the lake would be maintained by equalization culverts or other surface water conveyance structures (see Section 14.4.5, Mitigation Measures).

Groundwater Wells. There are 705 wells within 0.25 mile of the right-of-way of this alternative. Of these, eight are drinking water wells. There are 140 wells within the right-of-way of this alternative, one of which (Saratoga Springs Well #2) is used for drinking water. One addition drinking water well (Saratoga Springs Well #3) is with 100 feet of the Southern Freeway Alternative. UDOT will coordinate with the owners of any directly affected wells and with Saratoga Springs to mitigate the impacts to these wells (see the section titled Groundwater Wells on page 14-25).

Southern Freeway Alternative with Tolling Option

The Tolling Option for the Southern Freeway Alternative would not change the alternative's footprint, so it would not change the water quality impacts.

14.4.4.3 2100 North Freeway Alternative

As described in Chapter 2, Alternatives, this alternative would consist of a freeway extending from the Utah County line to SR 73 in Saratoga Springs and a lateral freeway extending east along 2100 North to I-15 in Lehi.

2100 North Freeway Alternative Impacts	
Water Quality Parameter	**Impacts**
Impervious area added	231 acres
Stream crossings	1
Groundwater wells within right-of-way	14

Surface Water Impacts

Impervious Area Added. This alternative would require 231 acres of new impervious area. The detention basins proposed as part of the project would be used to capture runoff from the roadway surface, which would reduce the flow rate of the runoff into adjacent water bodies and minimize erosion.

Stream Crossings. The 2100 North Freeway Alternative would cross the Jordan River at one location. No other streams would be crossed.

Numeric Analysis and Impacts to Impaired Waters and Beneficial Uses. The 2100 North Freeway Alternative would cross the Jordan River at one location. The water quality analysis conducted for the Arterials Alternative, which would cross the Jordan River three times, demonstrated that there would be no impacts to the beneficial uses or to the water quality status of the Jordan River as a result of that alternative (see Section 14.4.4.4, Arterials Alternative). Therefore, because the 2100 North Freeway Alternative has only one crossing, it is expected that the impacts to water quality from the 2100 North Freeway Alternative would be less than those from the Arterials Alternative and would likewise not change the water quality status or beneficial uses of the Jordan River.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from this alternative would be the same as those from the Southern Freeway Alternative.

Groundwater Flow. It is not expected that the 2100 North Freeway Alternative would impede groundwater flows. The flows in the area are to the south and west, and currently I-15 does not impede groundwater flows in the area. Therefore, a similarly sized 2100 North Freeway Alternative should not impede groundwater flows.

Groundwater Wells. There are 254 wells within 0.25 mile of the right-of-way of this alternative. Of these wells, five are drinking water wells. There are 14 wells within the right-of-way of this alternative, but none of these wells are used for drinking water. UDOT would compensate the owners of any affected wells within the right-of-way (see the section titled Groundwater Wells on page 14-25).

2100 North Freeway Alternative with Tolling Option

The Tolling Option for the 2100 North Freeway Alternative would not change the alternative's footprint, so it would not change the water quality impacts.

14.4.4.4 Arterials Alternative

As described in Chapter 2, Alternatives, this alternative would consist of a series of arterial roadways throughout northern Utah County. The combination of arterials includes a freeway segment from the Utah County line to SR 73 and arterial roadways at Porter Rockwell Boulevard, 2100 North, and 1900 South.

Arterials Alternative Impacts

Water Quality Parameter	Impacts
Impervious area added	334 acres
Stream crossings	6
Groundwater wells within right-of-way	92

Surface Water Impacts

Impervious Area Added. The Arterials Alternative would require 334 acres of new impervious area. The detention basins proposed as part of the project would be used to capture runoff from the roadway surface, which would reduce the flow rate of the runoff into adjacent water bodies and minimize erosion.

Stream Crossings. The Arterials Alternative would cross the Jordan River at Porter Rockwell Boulevard, 2100 North, and 1900 South and would also cross Dry Creek, Spring Creek, and the American Fork River.

Numeric Analysis. The Arterials Alternative is the worst-case scenario with regard to impacts to water quality because it would require the greatest amount of new impervious area and because it would cross the Jordan River at three locations (Porter Rockwell Boulevard, 2100 North, and 1900 South). For these reasons, the Arterials Alternative was selected for the numeric water quality analysis to assess its impact on the Jordan River (see Table 14.4-11 below).

Table 14.4-11. Modeled Water Quality in the Jordan River under the Arterials Alternative

Pollutant of Concern	Modeled In-Stream 3-Year Concentration	UAC R317 Standard[a]
Copper	0.004 mg/L[b]	0.013 mg/L
Lead	0.000 mg/L[b]	0.065 mg/L
Zinc	0.011 mg/L[b]	0.120 mg/L
TDS – Irrigation	581 mg/L[c]	1,200 mg/L
TDS – Stock watering	581 mg/L[c]	2,000 mg/L

[a] The UAC R317 standard is the highest in-stream concentration of the pollutant that can occur over a 3-year period.

[b] This is the highest in-stream concentration of the pollutant that is expected to occur over a 3-year period according to FHWA's modeling (see Section 14.4.1.5, FHWA Numeric Analysis).

[c] This is the concentration of TDS in highway runoff from the Stormwater Quality Data Technical Report (Salt Lake County 2000).

Impacts to Impaired Waters and Beneficial Uses. The numeric analysis shows that there would be no change to the water quality status or effects on the beneficial uses of the Jordan River. The numeric analysis used for the American Fork River under the Southern Freeway Alternative (see Table 14.4-10 above, Modeled Water Quality in the American Fork River under the Southern Freeway Alternative), which shows no change to the impaired water status or beneficial use, can also be applied to the Jordan River.

Groundwater Impacts

Groundwater Quality. The impacts to groundwater quality from this alternative would be the same as those from the Southern Freeway Alternative.

Groundwater Flow. The impacts to groundwater flow from this alternative would be the same as those from the Southern Freeway Alternative.

Groundwater Wells. There are 788 wells within 0.25 mile of the right-of-way of this alternative. Of these, 14 are drinking water wells. There are 92 wells within the right-of-way of this alternative, but none of these wells are used for drinking water. However, Saratoga Springs Well #2 is located near the Arterials Alternative (the alternative would be within source protection Zone 1, or within a 100-foot radius of the wellhead) and could be affected because of the proximity of the alternative to the wellhead. UDOT would mitigate the impacts to any affected wells within the right-of-way (see the section titled Groundwater Wells on page 14-25) and will coordinate with Saratoga Springs to determine what mitigation might be needed for the drinking water well.

Arterials Alternative with Tolling Option

The Tolling Option for the Arterials Alternatives would not change the alternative's footprint, so it would not change the water quality impacts.

14.4.4.5 Summary of Water Quality Impacts from the Utah County Alternatives

Table 14.4-12 summarizes the impacts to impervious area, stream crossings, and wells from the Utah County alternatives.

Table 14.4-12. Summary of Water Quality Impacts from the Utah County Alternatives

			Drinking Water Wells		All Wells	
Alternative	Additional Impervious Area	Stream Crossings	Within Right-of-Way	Within 0.25 Mile	Within Right-of-Way	Within 0.25 Mile
Southern Freeway	329	4	1[a]	8	140	705
2100 North Freeway	231	1	0	5	14	254
Arterials	334	6	0[a]	14	92	788

[a] The Southern Freeway and Arterials Alternatives are within about 100 feet of drinking water wells owned by Saratoga Springs.

14.4.5 Mitigation Measures

This section discusses mitigation measures associated with water quality, stream crossings, culvert design, and erosion protection for the permanent roadway. Mitigation measures were determined by consulting with the water quality agencies that are familiar with the impact analysis area.

14.4.5.1 Mitigation Measures for Surface Water Quality

The following mitigation measures were specifically mentioned by UDEQ. These measures are intended to reduce erosion and apply to all areas along the project that are proposed for construction. In addition to these measures, where appropriate, UDOT's Utah Pollutant Discharge Elimination System Phase II manual will be used.

- **Cut-and-Fill Slopes.** Provide erosion control on all cut-and-fill slopes by applying compost or mulch to the slope or through other means. Establish native vegetation on the slope where possible. Where possible, provide vegetated filter strips. Vegetated filter strips are UDEQ's preferred water quality treatment measures for the impact analysis area. Vegetation in filter strips slows the velocity of the stormwater enough that larger suspended particles settle out, metals can be taken up by the organic material in the soil, and the dissolved metal cations can be exchanged in the clay minerals in the soils or removed by the vegetation. The reduction in velocity also allows more time for oil and grease to volatilize, photodegrade, biodegrade, or be taken up by organic components in the vegetation or soils.

- **Detention Ponds.** Detention ponds will be provided for water quality treatment where it is necessary to detain runoff to reduce its peak flow rate. The proposed detention pond locations are shown in Figure 14-8 through Figure 14-13, Proposed Detention Pond Locations.

  In addition to reducing peaks and velocities in streams, detention ponds have the added benefit of reducing the levels of TSS, TDS, and metals in highway runoff. The benefits of detention ponds were assumed in the numeric analyses for Barney's Creek, the American Fork River, and the Jordan River (see Table 14.4-7, Table 14.4-10, and Table 14.4-11).

14.4.5.2 Mitigation Measures for Groundwater Flow

In areas of shallow groundwater, the proposed roadway embankments could compact the underlying soils and alter the groundwater flow. During the final design phase of the project, more detailed geotechnical evaluation and analysis will be required. At that time, UDOT will determine the impacts to the groundwater level from embankment fill, as well as appropriate mitigation measures. If groundwater is drawn to the surface by the project, flow toward Utah Lake will be maintained by equalization culverts or other surface water conveyance structures. If UDOT determines that the embankments would alter subsurface water elevations, groundwater flow will be maintained by one or more of the following methods: culvert, series of culverts, French drain, corrugated strip drain, synthetic drainage net, gravel layer, or other groundwater conveyance structures. Design and construction of groundwater conveyance structures, where necessary, will minimize the potential for changes to groundwater levels and flow patterns.

14.4.5.3 Mitigation Measures for Groundwater Wells

If a well needs to be relocated, UDOT will purchase the water right or the land associated with the right or negotiate an agreement with the water right owner to replace the well. Impacts to groundwater caused by encroaching on wells and drinking water source protection zones are unlikely to require a permit by the Utah Division of Water Quality (Herbert 2004).

Affected wells will be abandoned by a licensed well driller in accordance with Utah Administrative Code Section 655-4-12. The driller must contact the State

Engineer and provide an abandonment log when the closure is completed. Neat cement grout, sand cement grout, unhydrated bentonite, or bentonite grout will be used to abandon wells and boreholes (UAC R655-4).

14.4.6 Cumulative Impacts

This section summarizes the cumulative impacts to water quality from the MVC project and other future projects in the water quality impact analysis area. Chapter 25, Cumulative Impacts, provides a detailed analysis of cumulative impacts.

The geographic scope of the cumulative impacts analysis includes the Utah Lake–Jordan River Watershed Management Unit, which is in north-central Utah. This watershed management unit includes those streams that drain into Utah Lake and the Jordan River as well as the Jordan River's tributaries from Utah Lake to the Great Salt Lake. The timeframe of the water quality cumulative impact analysis is the mid-1970s through 2030. The mid-1970s was selected as the early date for the analysis because that is the earliest period for which data are available.

The rivers and lakes in the Utah Lake–Jordan River Watershed Management Unit have been extensively altered as a result of urban and agricultural development during the past century. Many of the streams that flowed into Utah Lake, the Jordan River, and the Great Salt Lake have been altered for water supplies, control of stormwater, agricultural uses, and urban development. The decrease in water quality was analyzed in the 2002 *Utah Lake–Jordan River Watershed Management Unit Stream Assessment* (Utah Division of Water Quality 2002). This report estimated that there are 1,314 perennial stream miles in the Utah Lake–Jordan River Watershed Management Unit, of which 1,025 miles (78.0%) were assessed for support of their designated beneficial uses. Of these, 848.5 miles (82.7%) were determined to fully support all identified beneficial uses, 108.3 miles (10.6%) were determined to partially support their beneficial uses, and 68.4 miles (6.7%) were determined to not support at least one designated beneficial use.

Regulatory controls have resulted in improved water quality in the Jordan River, which is the main water body that runs within the MVC study area. The quality of water has improved since the Clean Water Act was passed in 1972. Regulations on municipal waste from wastewater treatment plants, stormwater runoff, and industrial discharges have reduced the concentrations of pollutants discharged into the Jordan River (Hooton 1999). In addition, the *Jordan River Water Quality Total Maximum Daily Load Assessment* (Utah Division of Water

Quality 2005) noted that the water quality of the Jordan River has generally improved since a Section 208 Water Quality Plan was implemented in 1975.

The future water resource conditions in the water quality cumulative impact analysis area are difficult to predict accurately. For example, as urban development in the area continues, the amount of impervious surfaces will increase, but other pollutant sources from agriculture and resource extraction will decrease (because these lands will be converted to urban uses). Stormwater regulations could continue to evolve, resulting in new rules such as stricter controls from construction sites and new urban development.

Any of the MVC action alternatives would increase the amount of impervious surface by about 1,000 acres to 1,100 acres, which would increase the potential for stormwater pollution (see Table 14.4-13 below). However, the analysis conducted for the MVC project showed that the increase in the amount of impervious surface would not change the beneficial-use classifications or further impair water bodies in the area. In addition, the MVC project would include measures to control stormwater runoff and would use detention basins to minimize the amounts of pollutants that are discharged into nearby surface waters. Other transportation projects in the region are also not expected to contribute to major stormwater runoff or reduce water quality because of the controls would be placed on each project to manage runoff and minimize water quality impacts.

Urban runoff contributes about 6.2% of the stream water quality impairment. However, as development increases, this contribution would likely increase. Although development in the cumulative impacts analysis area will occur with or without the MVC project, roadway improvements in general could contribute to some development growth. It is expected that the amount of urbanized area along the Wasatch Front will increase from about 30,000 acres currently to about 70,000 acres in 2030, an increase of 40,000 acres. This urbanization would include all residential and commercial areas and the necessary infrastructure such as roads (including roads like the MVC). Not all of the 40,000 acres would be impervious surfaces, since the typical amount of impervious land cover in residential areas can vary from 12% to 40% and for commercial areas from 60% to 95% (Canter 1996).

In summary, the continued urbanization of Salt Lake and Utah Counties could result in cumulative impacts to and degradation of water quality. However, this increase in urbanization would also decrease the amount of agriculture and resource extraction, which are two of the larger factors that impair water quality. It is also likely that, in the future, regulatory controls would be increased to further reduce water quality impacts.

14.4.7 Summary of Impacts

Table 14.4-13 summarizes the water quality impacts from each combination of alternatives and options in Salt Lake County and Utah County.

Table 14.4-13. Summary of Impacts to Water Quality

Alternative	Additional Impervious Area (acres)	Stream Crossings	Drinking Water Wells		All Wells	
			Within Right-of-Way	Within 0.25 Mile	Within Right-of-Way	Within 0.25 Mile
5800 West Freeway / 5600 West Transit / Southern Freeway						
Dedicated Transit	1,110	23	2	28	312	1,601
Mixed Transit	1,108	23	2	28	320	1,599
5800 West Freeway / 5600 West Transit / 2100 North Freeway						
Dedicated Transit	1,012	20	1	25	186	1,150
Mixed Transit	1,010	20	1	25	194	1,148
5800 West Freeway / 5600 West Transit / Arterials						
Dedicated Transit	1,115	25	1	34	264	1,684
Mixed Transit	1,113	25	1	34	272	1,682
7200 West Freeway / 5600 West Transit / Southern Freeway						
Dedicated Transit	1,021	23	3	26	287	1,930
Mixed Transit	1,019	23	3	26	295	1,928
7200 West Freeway / 5600 West Transit / 2100 North Freeway						
Dedicated Transit	923	20	2	23	161	1,479
Mixed Transit	921	20	2	23	169	1,477
7200 West Freeway / 5600 West Transit / Arterials						
Dedicated Transit	1,026	25	2	32	239	2,013
Mixed Transit	1,024	25	2	32	247	2,011

14.5 References

Bernhard, Lynn

2005 E-mail from Bernhard, UDOT, to Terry Hsu of HDR Engineering regarding the use of salt in the Salt Lake Valley. August 9.

Bickford, Ira

2005 E-mail from Bickford, UDOT, to Terry Hsu of HDR Engineering regarding the use of fertilizers for highway roadsides in UDOT Region 2. August 8.

Canter, Larry

1996 Environmental Impact Assessment, Second Edition. Columbus, OH: McGraw-Hill.

[FHWA] Federal Highway Administration

1990 Pollutant Loadings and Impacts from Highway Stormwater Runoff. FHWA-RD-88-006.

1996 Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff. FHWA-RD-96-095.

Haraden, P.L.

2002 Salt Lake Valley. In: C.B. Burden and others, Groundwater Conditions in Utah, Spring of 2003. Utah Division of Water Resources Cooperative Investigations Report No. 44. Pages 24–37.

Herbert, Rob

2004 Personal communication between Herbert, Utah Division of Water Quality, and Laynee Jones of HDR Engineering regarding classified aquifers. September 30.

Hooton, LeRoy

1999 The Jordan River: Meeting Its Full Potential? www.slcgov.com/utilities/NewsEvents/news2001/news11052001.htm. March 16.

Jensen, Mark

2006 Spreadsheet and GIS files e-mailed from Jensen, Utah Division of Drinking Water, to Terry Hsu of HDR Engineering. March 3.

Lake Superior Duluth Streams

No date Understanding Water Quality Impacts. www.duluthstreams.org/understanding/impact_temp.html.

Patterson, Ralph

2005 Minutes of meeting between Patterson, UDOT Traffic Operation Center, and Terry Hsu of HDR Engineering regarding similar snowfall estimates for I-15 and the MVC. December 15.

Salt Lake County

2000 Stormwater Quality Data Technical Report. Prepared by Stantec Consulting. September.

[UDOT] Utah Department of Transportation

2003 Draft Utah Department of Transportation Stormwater Management Plan, Utah Pollutant Discharge Elimination System Phase II.

[USGS] United States Geological Survey

2001 Quality and Sources of Groundwater Used for Public Supply in Salt Lake Valley, Salt Lake County, Utah.

Utah Administrative Code R217-2-13, Classification of Waters of the State, as in effect February 17, 2006.

Utah Administrative Code R317-2-12, High-Quality Waters, as in effect May 10, 2007.

Utah Administrative Code R655-4, Water Well Drillers, as in effect June 1, 2007.

Utah Division of Water Quality

No date Jordan River Watershed Description. www.waterquality.utah.gov/watersheds/jordan/watershed_description.htm. Accessed July 27, 2004.

2002 Utah Lake – Jordan River Watershed Management Unit Stream Assessment. Prepared by Thomas Toole. August.

2004 Utah's 2004 303(d) List of Impaired Waters. April 1.

2005 Jordan River Water Quality Total Maximum Daily Load Assessment. May.

2006 Utah Division of Water Quality website.

2007 List of in-progress Total Maximum Daily Load studies. www.waterquality.utah.gov/TMDL/index.htm#inprogress. Accessed May 10, 2007.

Utah Division of Water Resources

1997a Summaries – Utah State Water Plans, Jordan River Basin Plan. www.water.utah.gov/planning/waterplans.asp. September. Accessed September 27, 2004.

1997b Summaries – Utah State Water Plans, Utah Lake Basin Plan. www.water.utah.gov/planning/waterplans.asp. December. Accessed September 27, 2004.

This page is intentionally blank.